PowerCom
COMMUNICATION TRANSDUCER

*M550-CT**

OPERATING MANUAL

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Update: M550 Version 4

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Revision 4

Date 20-10-2011

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M550 Version 4 update:

RS485 response time decreased to better than 10ms.

Choice of four Endian settings for floating point transmission.

Modbus 3X Register Order functions changed to 65 and 66.

Relay functions changed to 103 and 104.

Substitute MultiView for all references to Monitor95 or System Monitor.

Manual Ammendments:
Page 37: Changed 3X Modbus registers to odd numbers.
Page 42: Changed 4X Modbus registers to odd numbers.

Additional 4X registers:
40083 (0x0052) RESET Import kW.h Register (WO)
40085 (0x0054) RESET Export kW.h Register (WO)
40087 (0x0056) RESET Import kVAr.h Register (WO)
40089 (0x0058) RESET Export kVAr.h Register (WO)
40091 (0x005A) RESET kVA.h Register (WO)
40093 (0x005C) RESET Import A.h Register (WO)

For more information go to: www.multitek-ltd.com

M550 V4 Modbus 4X registers

Modbus	Register	Name	Mode
40001	(0x0000)	SYSTEM VOLTAGE	(R/W)
40003	(0x0002)	SYSTEM CURRENT	(R/W)
40005	(0x0004)	SYSTEM TYPE	(RO)
40007	(0x0006)	SYSTEM POWER	(RO)
40009	(0x0008)	DEMAND PERIOD	(R/W)
40011	(0x000A)	DEMAND STATUS	(RO)
40013	(0x000C)	Factoryuse	(ILLEGAL)
40015	(0x000E)	Factoryuse	(ILLEGAL)
40017	(0x0010)	RESET ALL ENERGY REGISTERS	(WO)
40019	(0x0012)	RESET DEMANDS	(WO)
40021	(0x0014)	CALIBRATE INPUT	(WO)
40023	(0x0016)	SET NODE ADDRESS	(WO)
40025	(0x0018)	Analogue o/p1 assignment (M560)	(R/W)
40027	(0x001A)	Analogue o/p1 nominal (M560)	(R/W)
40029	(0x001C)	Analogue o/p1 zero (M560)	(R/W)
40031	(0x001E)	Analogue o/p2 assignment (M560)	(R/W)
40033	(0x0020)	Analogue o/p2 nominal (M560)	(R/W)
40035	(0x0022)	Analogue o/p2 zero (M560)	(R/W)
40037	(0x0024)	Analogue o/p3 assignment (M560)	(R/W)
40039	(0x0026)	Analogue o/p3 nominal (M560)	(R/W)
40041	(0x0028)	Analogue o/p3 zero (M560)	(R/W)
40043	(0x002A)	RELAY ASSIGNMENT	(R/W)
40045	(0x002C)	RELAY DIVISOR	(R/W)
40047	(0x002E)	RELAY PULSE WIDTH	(R/W)
40049	(0x0030)	RESET FLASH/EEPROM DATA	(WO)
40051	(0x0032)	I/P V1 GAIN FACTOR	(R/W)
40053	(0x0034)	I/P V2 GAIN FACTOR	(R/W)
40055	(0x0036)	I/P V3 GAIN FACTOR	(R/W)
40057	(0x0038)	I/P I1 GAIN FACTOR	(R/W)
40059	(0x003A)	I/P I2 GAIN FACTOR	(R/W)
40061	(0x003C)	I/P I3 GAIN FACTOR	(R/W)
40063	(0x003E)	Factoryuse	(ILLEGAL)
40065	(0x0040)	Factoryuse	(ILLEGAL)
40067	(0x0042)	Factoryuse	(ILLEGAL)
40069	(0x0044)	Factoryuse	(ILLEGAL)
40071	(0x0046)	SET PASSCODE	(WO)
40073	(0x0048)	CALIBRATION PASSCODE	(WO)
40075	(0x004A)	DtoA PASSCODE(M560)	(WO)
40077	(0x004C)	DtoA1 OVERRIDE(M560)	(WO)
40079	(0x004E)	DtoA2 OVERRIDE(M560)	(WO)
40081	(0x0050)	DtoA3 OVERRIDE(M560)	(WO)
40083	(0x0052)	RESET Import kW.h Register	(WO)
40085	(0x0054)	RESET Export kW.h Register	(WO)
40087	(0x0056)	RESET Import kVAr.h Register	(WO)
40089	(0x0058)	RESET Export kVAr.h Register	(WO)
40091	(0x005A)	RESET kVA.h Register	(WO)
40093	(0x005C)	RESET Import A.h Register	(WO)
40095	(0x005E)	Future use	(R/W)
40097	(0x0060)	Future use	(R/W)
40099	(0x0062)	Future use	(R/W)
40101	(0x0064)	LOCK ACIA SETTINGS	(WO)

1.1 General

PowerCom M550 communication transducer is a complete measuring system in a single 100mm Din rail mount case. Measuring Phase Volts, Phase Current, Frequency, Active Power, Reactive Power, Energy and Demand. The M550 provides a RS485 modbus output and all above parameters can be monitored via the Modbus output.
Power Systems :-

	Product code
1 Ph.	*M550-CT1*
1 Ph. 3 Wire	*M550-CT1-3*
3 Ph. 3W unbalanced load	*M550-CT4*
3 Ph. 4W unbalanced load	*M550-MT9*

The M550 units are fully programmed by the factory and no further programming is necessary. If required, the User can reprogram parameters to individual requirements, such as the voltage and current ratios, relay output, demand times etc. These programming operations are covered in this manual.

The M550 uses a high speed microprocessor and analogue to digital conversion circuitry. Each phase current and voltage is measured continuously and all other parameters are derived from these measurements in the software. Voltage and current measurements are true RMS.

1.2 Parameters Measured

The M550 Measures the following parameters :

Phase Voltage (V), Phase Current (I), Frequency (Hz), Active Power per phase (W), System Active Power (W), Reactive Power per phase (VAr), System Reactive Power (VAr), Apparent Power per phase (VA), System Apparent Power (VA), Import Active Energy (W.h), Export Active Energy (W.h), Import Reactive Energy (VAr.h),

Export Reactive Energy (VAr.h), Power Factor per phase (P.F.), System Power Factor (P.F.), Amp Demand, Watt Demand, V A Demand, Maximum Amp Demand, Maximum Watt Demand, Maximum VA Demand.

1.2 Memory

All data including energy registers, current and voltage ratios and the calibration data is stored in a non volatile e^2prom. In power down (power loss) conditions all the information is retained. The e^2prom requires no battery or other circuitry to maintain the stored data.

1.3 Relay Output

The relay output provides a pulsed output corresponding to consumption Watt hour import or export, VAr hour import or export, A.h or VA.h consumption. The relay can be assigned to any of these parameters (see programming section 2.15.1).

The M550 automatically calculates the pulse rate and whether the units are W.h, kW.h or MW.h (VAr.h, kVAr.h or MVAr.h) etc from the nominal voltage and current inputs.

The relay is a normally open contact.

Pulse widths can be programmed into the M550, between 20 msec and 200 msec in steps of 20 msec. (See section 2.15.2).

1.4 Communications

The M550 provides RS485 output of all measured parameters.
The serial port option enables remote reading and programming of the M550 via a host computer, laptop etc. The RS485 use the Modbus protocol allowing multi-drop with up to 32 M550s connected in parallel. The RS485 Modbus protocol allows the M550 to be used with PC, PLC, RTU, Data loggers and Scada programs.

Software is available for programming and displaying parameters. Contact your local distributor for a free copy or visit our website www.multitek-ltd.com

1.5 LED indicator

The red LED on the front of the M550 serves three purposes:

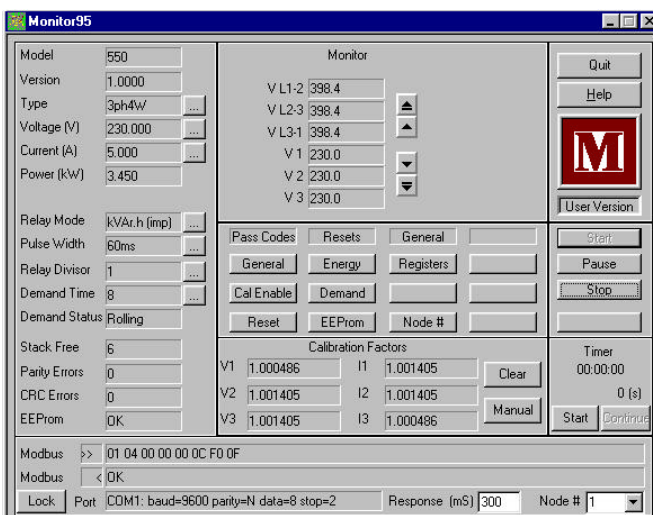
LED continually illuminated means that the power supply is o.k.

LED illuminated and flashing every 10 seconds means that the power supply o.k. and the M550 is communicating correctly.

LED illuminated and flashing every second and 2 flashes every 10 seconds means that the power supply o.k. the, and that the unit is communicating correctly, but there is no input measuring voltage signal.

2.1 Using the M550 Software Monitor 95. (M550 Software Monitor 95 can be obtained from your Multitek distributor, or the Multitek website www.Multitek-Ltd.com)

2.2 Open the Monitor95.exe file and the following screen will be displayed.



The following functions displayed relate to the PC or master node and are set by default to the following settings, Response time = 300mS, Node = 1, Baud Rate = 9600, Parity = None. It may not be necessary to alter the above settings but the communication port has to be opened by clicking on start and following section 2.5.

2.3 Changing Response Time

ACTION : Click Response Time Box.

COMMENTS :
Enter Value of response time. Minimum value 300mSec.

2.4 Changing Node Number

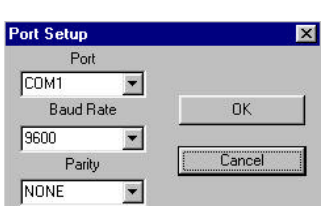
ACTION : Click Node No. Box.

COMMENTS :
Enter Node Number any number between 1 & 247.

2.5 Opening communication port.

ACTION : Click Start Button.

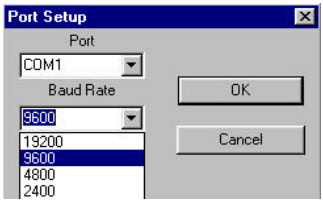
COMMENTS :
Port selection box appears, see below.



ACTION : Click Port Box.

COMMENTS :
Chose the PC's communication port click on Com 1 or Com 2

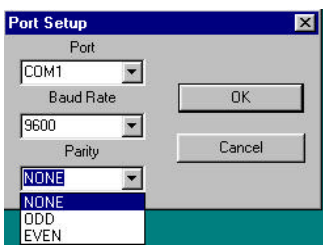
2.6 Changing Baud Rate.



ACTION : Click Baud Rate Box.

COMMENTS :
Chose Baud Rate. Either 2400, 4800, 9600, 19200.

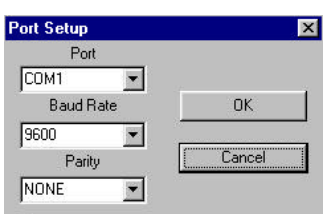
2.7 Changing Parity.



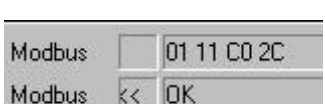
ACTION : Click Parity Box.

COMMENTS :
Choose Parity. Three options Odd, Even or None.

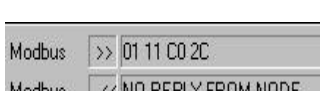
2.8 Starting Communication



ACTION : Once Comms Port, Baud Rate and parity are set, Click on O.K.
COMMENTS : If Communication is working message modbus OK appears in Modbus box.



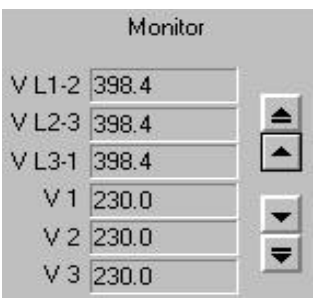
COMMENTS :
M550 and PC communicating correctly.



COMMENTS :
M550 and PC not communicating correctly.

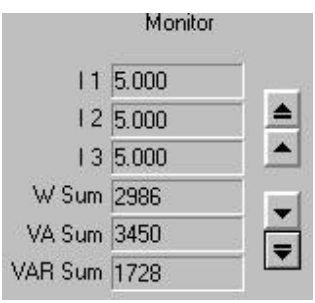
Note if wording in Modbus box is "NO REPLY FROM NODE". Check polarity connection of RS485 link at M550 and PC. Check that M550 has auxiliary power by checking Red LED on front of M550. If LED continually illuminated power supply o.k. If LED illuminated & flashing every 10 seconds, power supply ok M550 communicating ok. If LED flashes every second there is no measuring input voltage signal.

2.9 Displaying parameters being measured.
Once M550 is communicating with your PC you can now monitor different readings.



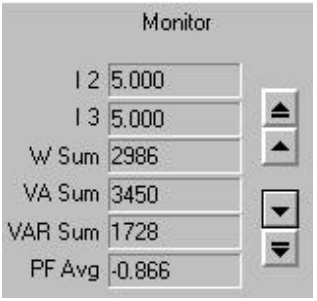
ACTION : None

COMMENTS : The 6 boxes show line to line voltage and line to neutral voltage for each phase. Note if unit is 3 phase 3 wire M550-CT4 V1,V2,V3 are the same as VL1-2, VL2-L3, VL3-1.



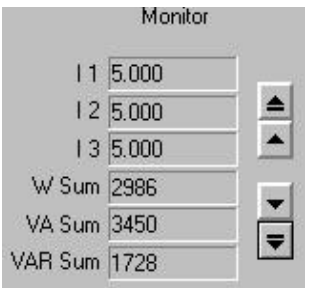
ACTION : Click on ***button.***

COMMENTS : The next six parameters being monitored are displayed. e.g I1,I2,I3, WSum, VA Sum, VAR Sum.



ACTION : Click on button.

COMMENTS : This button moves forward one parameter, and displays this parameter in the sixth box e.g. PF Avg is now shown.



ACTION : Click on button.

COMMENTS : This button moves back one parameter. e.g. now I1 is shown again.

Note: The buttons work as follows:

This button scrolls up one parameter.

This button scrolls up six parameters.

This button scrolls down one parameter.

This button scrolls down six parameters.

2.10 Stopping and pausing communication.

2.10.1 To pause communication.

ACTION : Click on Pause button.

COMMENTS : The communication pauses.

2.10.2 To restart communication.

ACTION : Click on Continue button.

COMMENTS : The communication restarts.

2.10.3 To stop communication.

ACTION : Click on Stop button.

COMMENTS : The communication stops.

ACTION : Click Start button.
COMMENTS : Follow instructions in section 2.8 i.e. click on O.K. button in port set up box and communication will start.

2.11 Starting timer.

The timer is real time clock provided by the Monitor program. It is useful for checking Watt hour readings etc.

ACTION : Click Start button.

COMMENTS : The timer starts.

ACTION : Click Stop button.

COMMENTS : The timer stops and gives option of resetting or continuing.

ACTION : Click Reset button.

COMMENTS : The timer resets to zero.

ACTION : Click Continue button.

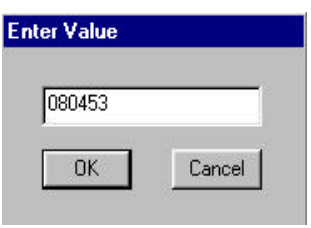
COMMENTS : The timer continues to count, displaying the total time from when counter initially started.

2.12 Security code. (General Pass Code)
To program different CT & VT ratios, demand times, etc. the General Pass Code must be entered. The General Pass Code is 080453. This is general pass code and is only applicable to Multitek M550 software. Pass Codes necessary for use with other software are listed in Section 4 page 45 of this manual.

2.12.1 Entering General Pass Code

ACTION : Click General Pass Code Button

COMMENTS : Enter value box is displayed.



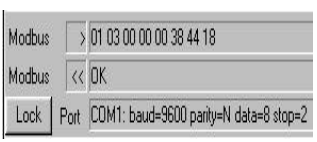
ACTION : Enter value

COMMENTS : Enter security code 080453 and click on OK button

2.13 Communications Lock.

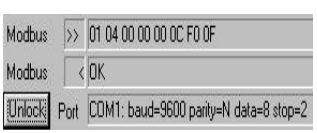
Response Time, Node Number, Communication Port, Baud Rate and Parity are dependant on the system and PC etc. that is being used. When connected to an existing Modbus network the M550 will automatically detect and configure itself to the network's settings. These settings can be locked into the EEPROM of the M550 to prevent unnecessary hunting. For a more detailed explanation of this facility see help file in the Monitor95 Software.

2.13.1 To Lock communications setting into the M550 EEPROM.



ACTION : Click Lock Button.
COMMENTS :
M550 communication port will be locked onto existing network settings.

2.13.2 To Unlock M550 communications settings.



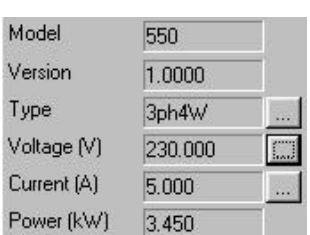
ACTION : Click Unlock Button.

COMMENTS :
M550 communication port is now unlocked.

2.14 Programming of nominal voltage and current inputs and ratios.

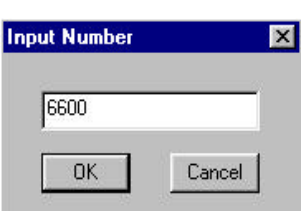
The program allows the user to program the nominal voltage and current inputs and ratios. Please note the ratios can be changed as long as the secondary (the input to the M550) stays as shown on the data label which is on the side of the product. For example if the M550 had been set by the factory to have a C.T. ratio 200/5A and the change required was for the input C.T. ratio to be 500/5A this can be achieved by program changes. But if the change required was for a C.T. ratio 500/1A then the unit would have to be returned to the factory or distributor to have the internal C.T. changed from 5A to 1A. The same applies to the voltage if the M550 input voltage is 110 Volts L.L then an external voltage transformer ratio can be programmed as long as the nominal input to the M550 stays at 110V L-L For example if the input was originally programmed for 6.6kV/110 and a V.T. of 11kV was required then this change could be achieved through software. (See example below)

2.14.1 Changing VT ratio.



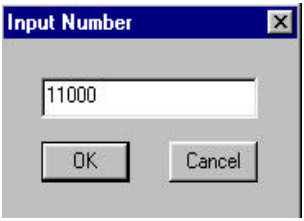
ACTION : Click Voltage Button.

COMMENTS : Enter Value box is displayed.



ACTION : None

COMMENTS : M550 is programmed for 6600V (6.6kV)

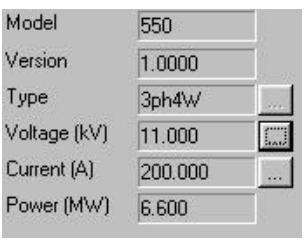


ACTION : Enter value

COMMENTS : Enter 11000 (11kV). Click on O.K.

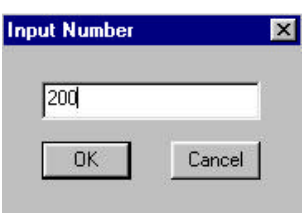
2.14.2Changing CT ratio.

For example to change for 200/5A change to 400/5 :-



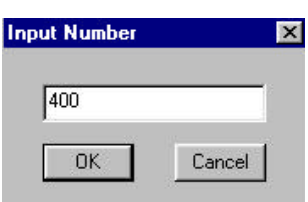
ACTION : Click Current Button.

COMMENTS : Enter Value box is displayed.



ACTION : None

COMMENTS : M550 is programmed to 200/5A

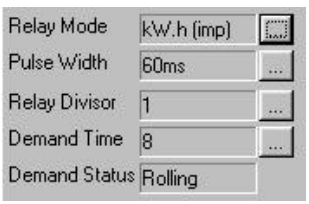


ACTION : Enter Value

COMMENTS : Enter 400 (400 Amps). Click on OK

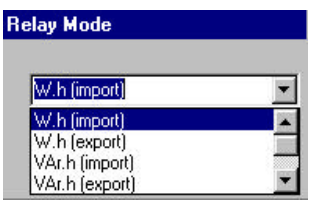
2.15 Pulsed Output (Pulsed output is an option. If the unit does not have this option please proceed to section 2.16) The M550 measures and displays W.h Import & Export, VAr.h Import & Export, VA.h, A.h. Any of these parameters can be assigned to the output relay to give pulses corresponding to which ever parameter is selected.

2.15.1 Selecting Parameter to be assigned to relay for pulsed output.



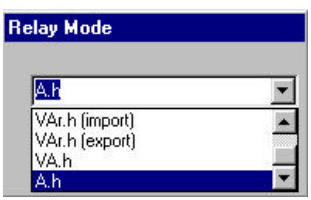
ACTION : Click On Relay Mode Button.

COMMENTS : Relay Mode box is displayed.



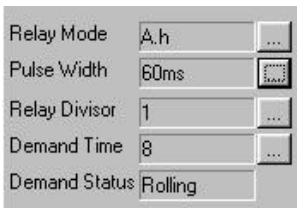
ACTION : None

COMMENTS : Relay is assigned W.h Import. (Watt Hour Import)



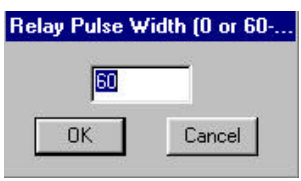
ACTION : Select Parameter to be assigned to relay output.
COMMENTS : Using the up and down cursor you can scroll through the parameters available. In this example A.h (Ampere Hours) has been selected, click on OK Button.

2.15.2 Selecting Relay output pulse width.
The pulse width can be set between 0msec (off) and 200msec, in steps of 20msec.



ACTION : Click On Pulse Width Button.

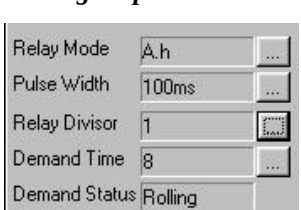
COMMENTS : Pulse Width Selection box is displayed.



ACTION : Enter value between 20msec and 200msec.

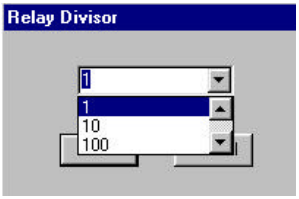
COMMENTS : Pulse widths are in steps of 20msec. If 60msec enter 60 and click on OK.

2.15.3 Selecting Relay Divisor
This allows the user to set the relay to pulse every 1, 10 , 100 or 1000 counts. i.e. If the divisor is set to 1 every time M550 registers and stores 1 count relay the pulses once. If set to 100, the relay only pulses once after M550 has registered and stored 100 counts. The M550 always registers and stores the number of counts regardless of what the relay divisor is set to. i.e. If the kilowatt consumption was 500 kW per hour and relay divisor was set to 100 you would get 5 pulses an hour.



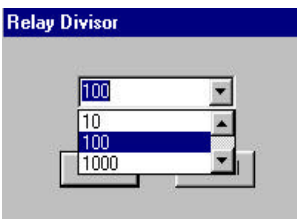
ACTION : Click On Relay Divisor Button.

COMMENTS : Divisor selection box is displayed.



ACTION : None

COMMENTS : Divisor set for 1. This means after every 1 unit that M550 counts the relay pulses once.

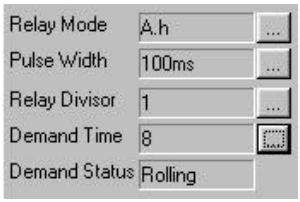


ACTION : Select Divisor required.

COMMENTS : Using the up and down cursor you can scroll through the divisor values available. If a divisor value of 100 is required select 100 and Click on OK.

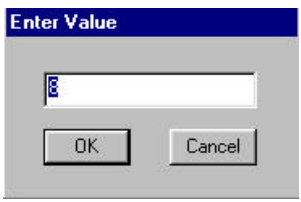
2.16 The M550 measures Wd (Average Watt Demand Import & Export) VAd (Average VA Demand) Ad (Average Amp Demand) Max Wd (Maximum Watt Demand Import & Export) Max VAd (Maximum VA Demand) Max Ad (Maximum Amp Demand). Demand times between 3 and 30 minutes can be programmed in 1 minute steps. The M550 samples the instantaneous values for 1 minute then takes the average of these samples and updates the memory. This sampling and updating every minute continues until the time period selected is reached. e.g. If time period is 15 minutes then after 15 minutes the average of 15 minute demand is displayed. When the 16th minute is reached the M550 takes the average of minute 2 to 16 and updates the memory. The Maximum Demand is the highest value recorded by M550 from being powered up. This value is retained until either registers are reset or auxiliary power is removed.

2.16.1 Programming demand periods.
Example to change from 8 min to 30 min demand period :



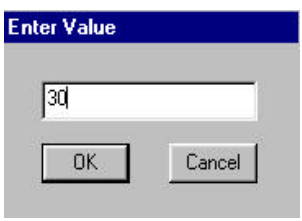
ACTION : Click On Demand Button.

COMMENTS : "Enter Value" box is displayed.



ACTION : None.

COMMENTS : M550 is programmed for a demand time of 8 minutes.



ACTION : Enter Value.

COMMENTS : Enter 30 (30 minutes). Click on OK Button.

2.17 Resetting of energy registers. The ENERGY reset programming mode allows the User to reset the Watt hour register import and export (W.h, kW.h, MW.h) the VAr hour register import and export (VAr.h, kVAr.h, MVAr.h) VA.h registers and A.h registers to zero.

ACTION : Click On Energy Button

COMMENTS : All energy registers are reset to zero.

2.17 Resetting of demand period.
The Demand reset programming mode allows the User to reset the demand period to zero. i.e Wd (Average Watt Demand Import and Export) VAd (Average VA Demand) Ad (Average Amp Demand) Max Wd (Maximum Watt Demand Import and Export) Max VAd (Maximum VA Demand) Max Ad (Maximum Amp Demand)

ACTION : Click Demand Button.

COMMENTS : All Demand registers are reset to zero.

2.18 It is possible to reset all registers by clicking on the EEProm button. This sets all Demand and Energy registers to zero. It resets Voltage, Current, System Type and Demand Period to Default Settings, shown below :
Voltage : 230V LN
Current : 5A
Type : 3 Phase 4 Wire
Demand Period : 8 minutes

2.18.1 Resetting All Registers

ACTION : Click EEProm Button.

COMMENTS : All registers are reset.

2.19 Modbus Registers
This operation sets the order of the Modbus registers in the M550 being monitored. For more information on how to set the order of the Modbus registers in a M550 see section 3.

ACTION : Click On Registers Box

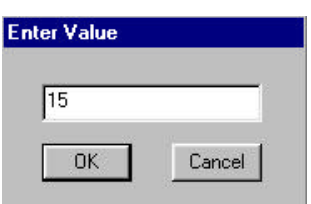
COMMENTS : The order of the displayed measurements now matches that of the Modbus registers in the node. See section 3

2.20 Setting of Node Addresses.
The number of node addresses available is 1 to 247. Each individual M550 that is to be connected to a common bus, must have its own unique node address.

Note : All M550 instruments are set by the factory to the default node number 1 but all respond to a query using address 254. This allows any M550 to communicate on any existing Modbus network. Once the unit has communicated successfully the node number required can be set as follows.

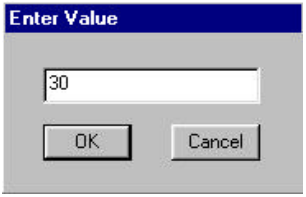
ACTION : Click On Node Number Button.

COMMENTS : Enter Value box is displayed.



ACTION : None

COMMENTS : M550 is set to Node 15.

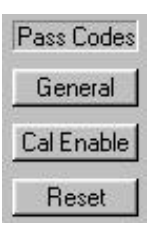


ACTION : Enter Node Address Required.

COMMENTS : Example if node address 30 is required enter 30 and click OK Button

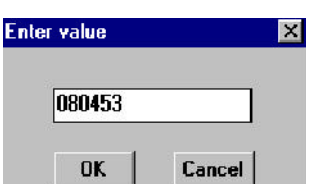
2.21 Calibration Factors.
This option allows the user to re-calibrate the M550 without using live voltage and current inputs
To enable the user to complete this, all the calibration data has to be manually recorded and kept. It is suggest that the user makes a note of the values and stores them with the a note of the serial number of the M550 being used.

2.21.1 Calibration Enable.
Before the calibration part of the program can be used the Calibration Enable Password has to be entered. The code is the same as General Password 080453 for the M550 monitor software. (See page 45 for programming codes)



ACTION : Click Cal Enable Button.

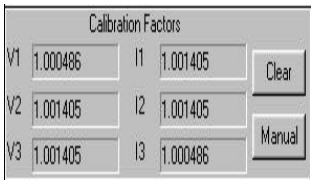
COMMENTS : Enter Value box is displayed.



ACTION : Enter value.

COMMENTS :
Enter security code 080453 and click on OK Button

2.21.2 Reading Calibration Data

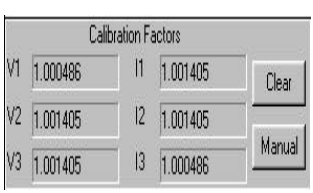


ACTION : Manually record calibration figures for V1, V2, V3, I1, I2, I3.

COMMENTS : These values must be stored with the serial number of the M550 as these numbers are unique to the M550 under test.

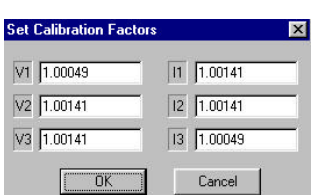
Note Only complete the following operation in 2.21.3 if the calibration data has been lost and you have recorded original calibration data.

2.21.3 Entering Calibration Data



ACTION : Click on Manual Button.

COMMENTS : Enter Value box is displayed.

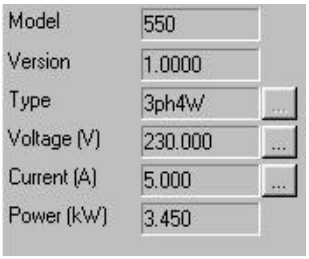


ACTION : Enter value .

COMMENTS : Enter recorded values into V1, V2, V3, I1, I2, I3 click on O.K.

The Clear button clears all calibration data from the calibration registers and sets them all to 1.000000.

2.25 Additional Information that M550 Monitor95 provides :

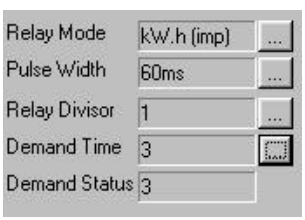


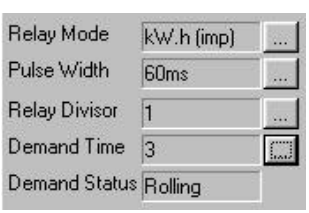
Model = Model No 550

Version = Software version number

Type = System Type. either 3ph 4W (3 phase 4 wire unbalanced load) or 3ph 3W (3 phase 3 wire unbalanced load) or 1ph 3W (single phase 3 wire) 1 ph (single phase load)

Power = Total power when nominal input is applied.





Demand Status = This reads the state of the demand count-down timer. When integration starts, the counter loads in the demand period and counts down towards zero each minute. The value returned from the M550 is the number of minutes remaining before the unit starts its sliding window mode. Once sliding window mode is reached display changes to Rolling

Stack Free = Nodes internal program, stack state.

Parity Errors = number of errors since node cold started.

CRC errors = Number of CRC errors since node cold started.

EEprom = Indicates O.K. or error.

Quit = Ends program.

Help = Provides help files.

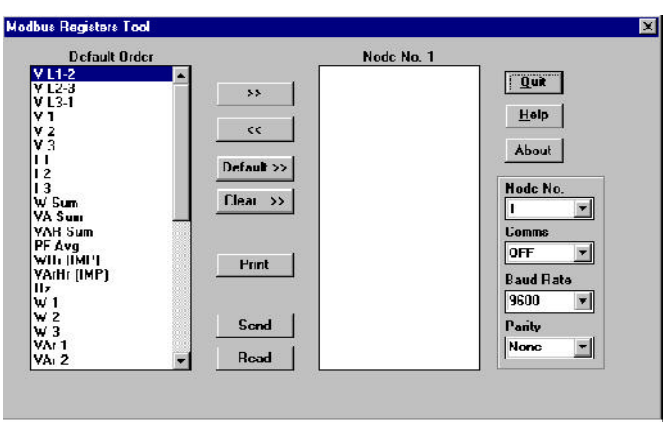
3.0 PROGRAMMING MODBUS REGISTERS SEQUENCE

If changing of the modbus order is not required please move to section 4.0 communication.

3.1 Using the M550 Software.
M550 software can be obtained from your Multitek distributor or from our website www.multitek-ltd.com.

3.2 Load disc and open Mbregs, (This is the Modbus Registers Tool program) and the screen below will be displayed.

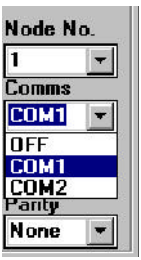
4.3 This software allows the user to alter the sequence in which the Modbus addresses are read. So for example if the user was only interested in Watts Hz Power Factor, then these 3 registers could be set as the first 3 and the remaining registers ignored.



The following parameters are set by default to the following readings, all can be changed if required. See section 2.3 to 2.6. Response time = 300mS, Node = 1,

Baud Rate = 9600, Parity = None

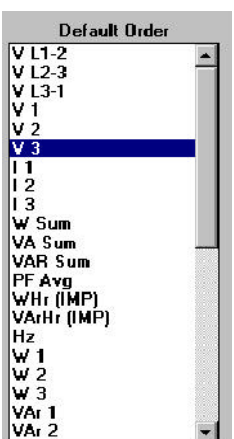
3.4 Opening communication port.



ACTION : Click on Comms Button.

COMMENTS :
Choose which communication port, 1 or 2. Click on Comms 1 or Comms 2

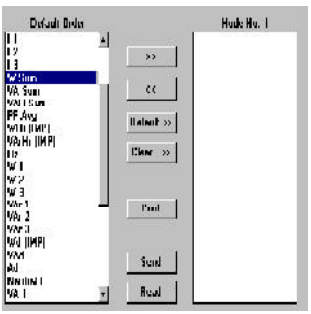
3.5 Programming Modbus Register Sequence.



ACTION : Click on Default Order Box

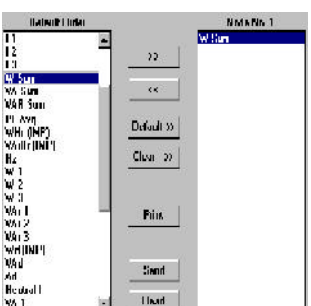
COMMENTS :
Using Up and Down cursor you can scroll through all parameters that are available and see the order that they will appear in. This order can be changed.

For Example if the order required is Total Watt (W sum), System Frequency (Hz), Average Power Factor of System (PF Avg) and Maximum VA Demand (Max VAd) This sequence can be set as follows.



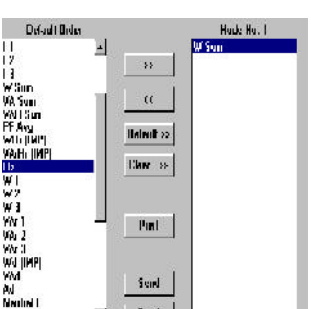
ACTION : Scroll Through to W Sum.

COMMENTS :
W Sum is highlighted.



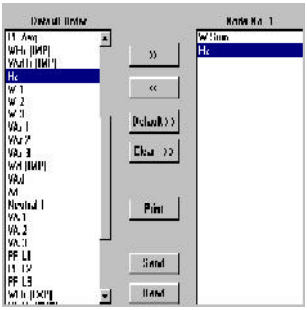
ACTION : Click on >> Button.

COMMENTS :
W Sum (This appears in Node No Box)



ACTION : Scroll Through to Hz

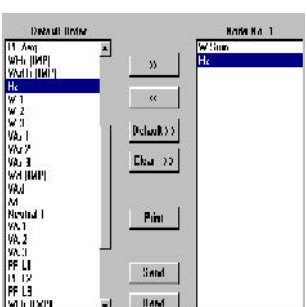
COMMENTS :
Hz is highlighted.



ACTION : Click >> Button.

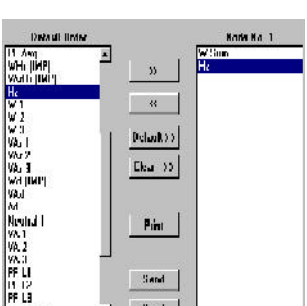
COMMENTS :
Hz (This appears in Node No Box)

Repeat the sequence of highlighting the parameter required and clicking on >> until all parameters required are in the sequence required in the Node No 1 box. Then complete the following operations to send and read these parameters.



ACTION : Click Send Button.

COMMENTS :
All information in the Node No box is sent to the M550



ACTION : Click Read Button.

COMMENTS :
All information in the Node No box is read and stored by the M550. This also adds any of the parameters not selected into Node No Box, these will appear below the selected parameters.

Note. The parameters not selected are placed in the default order after the parameters chosen.

3.6 Additional Options the Modbus Register Tool Program Offers.

<< = If you wish to remove a parameter from Node No Box, highlight the parameter and click on <<

Default = Clicking on default overrides parameters in Node No Box and replaces them in the Default order.

Clear = Clicking on Clear removes all parameters from the Node No Box.

Print = Allows printing of parameter order.

4.0 RS485 COMMUNICATION

The RS 485 allows remote reading and programming of the M550 via a host computer. The communication protocol used is a subset of Modicons Modbus, (see section 4.1) enabling the use of standard host computer, PLC and scada programs. Up to 32 PowerCom M550s can be connected in parallel to a single communication bus.

4.1 M550 Modbus Protocol

4.1.1 Physical Connections

The interface to the Modbus network is via the RS485 connection. This takes the form of a twisted pair cable preferably screened, onto which up to 32 devices may be connected, one of which will be the host PC or controller node. The devices on the network are connected in parallel + to +, - to - and shield to shield (screen to screen). The shield should be connected to earth at one point of the network only. Other manufacturers of devices intended for use on the Modbus network may have different + and - designations : some have Hi, Lo or A ,B. In any case reversing the + and - connections may have the desired results if the device fails to communicate with the master node.
The maximum length of the twisted pair cable specified by the RS standard is 1.2km. Any length over 200m should be terminated at each end with a resistor equal to the cable's characteristic impedance in series with a 0.1µF capacitor. A typical network cable is Beldon 8761.

4.1.2 Communication Format

Baud rate : 2400, 4800, 9600, 19200
Low level character format :
With Odd or Even parity = 1 start bit, 8 data bits, 1 parity bit, 1 stop bit
With NO parity = 1 start bit , 8 data bits, 2 stops bits.

4.1.3 Modbus Format

Data format :
RTU
32 bit, floating point format to IEEE-754 standard, exponent bias 127, most significant byte transmitted first. There is no word reversal.

Address range: 1-247

Error Check :
Cyclic Redundancy Check (CRC), Polynomial exclusive OR value A001h Low byte sent first.

4.3.5 Modbus Protocol

Only the RTU (Remote Terminal Unit) form of the Modbus protocol will be supported and all references in this sheet refer to RTU format.

Typically, the master or controller requests data from its slaves by polling them one at a time and waiting for a pre-defined amount of time for a response. If a node doesn't respond within this time period the master will try accessing it a further two times before indicating to the Scada system that the node has gone off-line or there is a fault with it. If all is well the node will respond with the data requested.

A typical communication 'packet' will be in the form : [Node Address] [Function] [Byte count, Data etc.] [Error check].

Because Modbus is a word (2 byte) orientated protocol, floating point (4 byte) register numbers are counted in multiples of two.

viz register 1 = start address 0
register 2 = start address 2
register 3 = start address 4
register 4 = start address 6
Formula = (register required -1) x2

This also applies to the number of registers requested. If 2 registers are requested the number of WORDS in the packet's [Number of registers] slot should equal 4. (See examples in the following sections.

CRC Calculations
To calculate the Cyclic Redundancy Check value.
Load a word register with 0xFFFF (CRCREG)
Repeat the following for each character in the Modbus packet
{
XOR the low byte of the word register with the next (or first) character in the buffer
Repeat the following for the whole character
{
Get the state of the lsb of CRCREG Low byte
Shift the CRCREG right by one bit shifting in a zero in the msb
If the bit shifted out is a logical 1, XOR CRCREG with 0xA001
}
}
CRCREG contains the CRC of the buffer

4.3.6 Timing

RTU frame timing :
The message starts with an interval of at least 3.5 character times.
Following the last transmitted character, a similar interval of a least 3.5 character times marks the end message.
The entire message frame must be transmitted as a continuous stream.

4.3.7 Response time.

Modbus response time from reception of the last character to the transmission of the 1st character in its reply is less than 200 msec.

4.3.8 Codes Supported

***Function 3 (03 hex)** Read holding registers. (4X)*

***Function 4 (04 hex)** Read input registers. (3X)*

***Function 16 (10 hex)** Preset Multiple register. (4X)*

***Function 17 (11 hex)** Report slave ID*

***Function 30 (1E hex)** Modbus register order Write*

***Function 31 (1F hex)** Modbus register order Read*

BROADCAST is not supported and this command does not cause the slave to respond to the master.

An EXCEPTION error will be generated if the node cannot fulfil the task set by the Master or the Slave receives invalid data in its data slot.

Exception code table

Code	*Name*
01	*Illegal Function*
02	*Illegal Data Address*
03	*Illegal Data Value*

4.3.8 Modbus Codes Reference

Function 4 (04 hex) - read input registers. (3X)
These registers contain the measured and calculated values of the instrument. Register addresses in the instrument start at 0 but in keeping with Modicon Modbus codes, are designated addresses starting at 30001.

Packet from master format :
[Node Addr][04][reg start addr(2 bytes)][No. of reg (2 bytes)] [CRC(2 bytes)]
Response from slave format:
[Node Addr][04](Byte count][Data (byte count bytes)][CRC(2 bytes)]

The following table lists the parameters with the Modbus equivalent address and its address within the M550. Any data requested that isn't applicable to the conditions column will return the value -ve infinity (FFFFFFFFh)

3X Registers

The registers are listed with their Modbus addresses.
The data held at these addresses are Read-Only.
3X registers are read using function 04h.

A sample write packet will look like this:-

[Node][04][start address][No. of Double Registers Requested][CRC(2 bytes)]

e.g. To read line to neutral voltages on node 23h:-

[23h][04h][0006h][0006h(3, 4 byte regs)] [CRC(2 bytes)]
The node's return packet will look like:-
[23h][04h][000Ch][12 bytes of data = 3 floating point numbers] [CRC(2 bytes)]

The list below is the default order of the 3X registers in M550. The order can be altered using the Modbus Registers Tool Program, (see section 4), or by a suitable SCADA program.

Modbus Add.	Register Add.	Register Name	Order No.
30001	(0x00)	V L1-2	1
30003	(0x02)	V L2-3	2
30005	(0x04)	V L3-1	3
30007	(0x06)	V 1*	4
30009	(0x08)	V 2*	5
30011	(0x0A)	V 3*	6
30013	(0x0C)	I 1	7
30015	(0x0E)	I 2	8
30017	(0x10)	I 3	9
30019	(0x12)	W Sum	10
30021	(0x14)	VA Sum	11
30023	(0x16)	VAR Sum	12
30025	(0x18)	PF Avg	13
30027	(0x1A)	WHr (IMP)	14
30029	(0x1C)	VArHr (IMP)	15
30031	(0x1E)	Hz	16

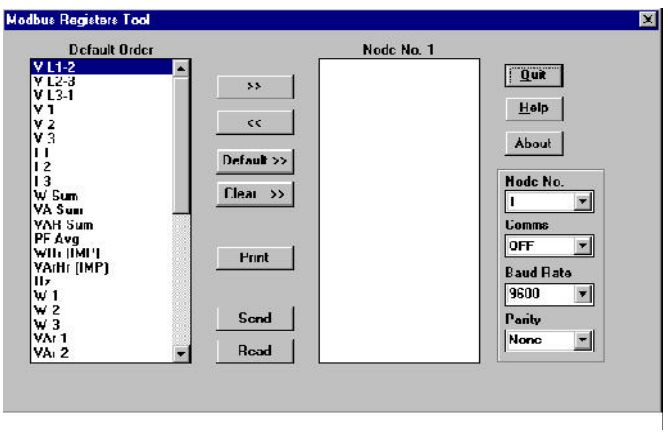
Continued :-

Modbus Add.	*Register Add.*	*Register Name*	*Order No.*
30033	*(0x20)*	*W 1*	*17*
30035	*(0x22)*	*W 2*	*18*
30037	*(0x24)*	*W 3*	*19*
30039	*(0x26)*	*VAr 1*	*20*
30041	*(0x28)*	*VAr 2*	*21*
30043	*(0x2A)*	*VAr 3*	*22*
30045	*(0x2C)*	*Wd (IMP)*	*23*
30047	*(0x2E)*	*VAd*	*24*
30049	*(0x30)*	*Ad*	*25*
30051	*(0x32)*	*Neutral I*	*26*
30053	*(0x34)*	*VA 1*	*27*
30055	*(0x36)*	*VA 2*	*28*
30057	*(0x38)*	*VA 3*	*29*
30059	*(0x3A)*	*PF L1*	*30*
30061	*(0x3C)*	*PF L2*	*31*
30063	*(0x3E)*	*PF L3*	*32*
30065	*(0x40)*	*WHr (EXP)*	*33*
30067	*(0x42)*	*VArHr (EXP)*	*34*
30069	*(0x44)*	*VAHr*	*35*
30071	*(0x46)*	*AHr*	*36*
30073	*(0x48)*	*Wd (EXP)*	*37*
30075	*(0x4A)*	*Max Wd (IMP)*	*38*
30077	*(0x4C)*	*Max Wd (EXP)*	*39*
30079	*(0x4E)*	*Max VAd*	*40*
30081	*(0x50)*	*Max Ad*	*41*

In 3 wire mode system V1, V2, V3 will have same value as volts L2-L1, L3-L2, L1-L3

Modbus Register Order: Overview (also see section 4 and help file of M550 software)

M550 has the facility to reorder its Modbus 3X registers to suit an existing Modbus network.
The Modbus Registers Tool program provides an easy method of achieving this.



The order of the registers in any node connected to the network can be read by the program by clicking on the READ button.

The list can be modified (using the CLEAR, DEFAULT, << and >> buttons) to enable the most accessed parameters to appear first in the Node's list, thereby optimising the speed of the system. The default order for the registers is listed in the left hand area of the dialog box. Simply clear the right hand list box and enter the register order required.

The same results can be achieved by using Modbus function code 1Eh (30) to send a string of data to set the order of the registers. The order will automatically be saved in EEPROM.

A sample write packet will look like this:-

[Node][1E][start address][No. of Double Registers][Data length in bytes] [REGISTERS][CRC(2 bytes)]

It is important to remember that each register in the packet's data field contains two references to the registers to be reordered.

e.g. To set the 41 Modbus registers to their default order in node 23h:-

[23h][1Eh][23h][1Eh][0000h][002Ah][0102h][0304h][0506h][0708h][090Ah][0B0Ch][0D0Eh][0F10h][1112h][1314h][1516h][1718h][191Ah][1B1Ch][1D1Eh][1F20h][2122h][2324h][2526h][2728h][29XX][CRC(2bytes)]

N.B. XX = don't care.
To read the order of the registers use code 1F (31)
eg. [23h][1F][0000][0018h][CRC(2bytes)]

Example
To obtain all 3 line powers in a 4 wire system on Node 23h
Packet from master :

Start at Power L1 (0020), request 3 regs (0006 words)
[23][04][0020][0006][CRC(2bytes)]
Response from slave format :
[23][04][12 bytes of data(3 regs x 4 bytes)][CRC(2 bytes)]

<u>Function 3 (03 hex)</u> - Reading registers (4X)
These registers contain the system setting and controls. Register addresses in the instrument start at 0, but in keeping with Modicon Modbus codes, are designated addresses starting at 40001.

Read
Packet from master format :
[Node addr][03][Register start addr.(2 bytes)][No of reg(2 bytes)][CRC (2 bytes)]
Response form Slave format :
[Node addr][03][Byte count][Data(byte count bytes)][CRC (2 bytes)]

Function 16 (10 hex) - Preset Multiple registers (4X)
These registers contain the system settings and controls. Register addresses in the M550 at 0, but in keeping with Modicon Modbus codes, are designated addresses starting 40001.

Write
Packet from master :
[Node addr][10][Register start address(2 bytes)][No of registers(2 bytes)][Byte count][Data (byte count bytes)] [CRC (2 bytes)]

Response from slave format :
[Node addr][10][Register start addr.(2 bytes)][No of registers(2 bytes)][CRC (2 bytes)]

The following table lists the parameter, its Modbus equivalent address and its address within the M550. Any Illegal operation will return an Error code.

4X Registers
The registers are listed with their Modbus addresses. The data held at these addresses are Read-Only, Write-Only or Read+Write as indicated below.
4X registers are read using function 03h and written using function 10h.
A sample write packet will look like this:-

[Node][10][start address][No. of Double Registers][Data length in bytes][CRC(2 bytes)]

e.g. To set Node 23h System Voltage and System Current together:-

[23h][10h][0000h][0004h(4, 2 byte regs)][08h(2, 4 byte regs)][CRC(2 bytes)]

Modbus Add.	*Register Address/Name*	*Mode*
40001	*(0x00) SYSTEM VOLTAGE*	*(R/W)*
40003	*(0x02) SYSTEM CURRENT*	*(R/W)*
40005	*(0x04) SYSTEM TYPE*	*(R/W)*
40007	*(0x06) SYSTEM POWER*	*(RO)*
40009	*(0x08) DEMAND PERIOD*	*(R/W)*
40011	*(0x0A) DEMAND TIMER*	*(RO)*
40013	*(0x0C) RELAY DIVISOR*	*(R/W)*
40015	*(0x0E) RELAY PULSEWIDTH*	*(R/W)*
40017	*(0x10) RESET ENERGY*	*(WO)*
40019	*(0x12) RESET DEMANDS*	*(WO)*
40021	*(0x14) CALIBRATE INPUT*	*(WO)*
40023	*(0x16) SET NODE ADDRESS*	*(WO)*
40025	*(0x18) Future use*	*(R/W)*
40027	*(0x1A) Future use*	*(R/W)*
40029	*(0x1C) Future use*	*(R/W)*
40031	*(0x1E) Future use*	*(R/W)*
40033	*(0x20) Future use*	*(R/W)*
40035	*(0x22) Future use*	*(R/W)*
40037	*(0x24) Future use*	*(R/W)*
40039	*(0x26) Future use*	*(R/W)*
40041	*(0x28) Future use*	*(R/W)*
40043	*(0x2A) RELAY ASSIGNMENT*	*(R/W)*
40045	*(0x2C) RESET EEPROM DATA*	*(WO)*
40047	*(0x2E) I/P V1 GAIN FACTOR*	*(R/W)*

40049	*(0x30) I/P V2 GAIN FACTOR*	*(R/W)*
40051	*(0x32) I/P V3 GAIN FACTOR*	*(R/W)*
40053	*(0x34) I/P I1 GAIN FACTOR*	*(R/W)*
40055	*(0x36) I/P I2 GAIN FACTOR*	*(R/W)*
40057	*(0x38) I/P I3 GAIN FACTOR*	*(R/W)*
40059	*(0x3A) Future use*	*(ILLEGAL)*
40061	*(0x3C) Future use*	*(ILLEGAL)*
40063	*(0x3E) Future use*	*(ILLEGAL)*
40065	*(0x40) CLEAR GAIN FACTORS*	*(WO)*
40067	*(0x42) SET PASSCODE*	*(WO)*
40069	*(0x44) CALIBRATION PASSCODE*	*(WO)*
40071	*(0x46) D to A PASSCODE*	*(WO)*
40073	*(0x48) D to A1 OVERRIDE*	*(WO)*
40075	*(0x4A) D to A2 OVERRIDE*	*(WO)*
40077	*(0x4C) D to A3 OVERRIDE*	*(WO)*
40079	*(0x4E) Future use*	*(R/W)*
40081	*(0x50) Future use*	*(R/W)*
40083	*(0x52) Future use*	*(R/W)*
40085	*(0x54) Future use*	*(R/W)*
40087	*(0x56) Future use*	*(R/W)*
40089	*(0x58) Future use*	*(R/W)*
40091	*(0x5A) Future use*	*(R/W)*
40093	*(0x5C) Future use*	*(R/W)*
40095	*(0x5E) Future use*	*(R/W)*
40097	*(0x60) LOCK ACIA SETTINGS*	*(WO)*
40099	*(0x62) Future use*	*(R/W)*
40101	*(0x64) Future use*	*(R/W)*
40103	*(0x66) Future use*	*(R/W)*

N.B.

Addresses 40001 to 40003 are common to M550, MultiDin and MultiGen.

Addresses 40005 to 40019 are common to M550 and MultiDin.

Example. To obtain System Volts & System Amps on Node 23h
Packet from master format :
Start at system voltage (0000), request 2 regs (0004 words)
[23][03][0000][0004][CRC(2 bytes)]

Response from slave format ;
[23][03][08][8 bytes of data(2 regs x 4 bytes)] [CRC (2 bytes)]

To set both System Volts and System Amps on Node 23h
Packet from the master format :
Start at system voltage (0000), set 2 regs (0004 words)
[23][10][0000][0004][08][8 bytes of data (2 regs x 4 bytes)]
[CRC (2 bytes)]
Response from slave format :
[23][10][0000][0004][CRC(2 bytes)]

<u>Function 17 (11hex)</u> - Report Slave ID
This function returns 10 floating point values.

To obtain ID on Node 23h
Packet from master format :
[23][11][CRC(2 bytes)]
Response from slave format :
[23][11][28][40 bytes of data (10 regs x 4 bytes)][CRC(2 bytes)]

Modbus Report Slave ID Function (code 11h)

This function returns the status of the M550.
The returned packet consists of 10, four byte floating point numbers.(IEEE754)

1) Identification code of the node.
2) The amount of internal stack that hasn't been used.

3) The number of parity errors detected by the node.(counts up to 255 then flips over to zero)
4) The number of framing errors detected by the node.(counts up to 255 then flips over to zero)
5) Firmware Revision Number
6) EEPROM status 0 = OK, 101 = Corrupted
7) State of the Comms Lock
8) Not used but transmitted
9) Not used but transmitted
10) Not used but transmitted
N.B. Addresses 01 to 04 are common to M550, M560 MultiDin and MultiGen.

4.3.9 Password Code Numbers.
If M550 is being used with Multitek M550 software all relevant codes are detailed in section 2. If user is using other software, the codes required are as follows :-

General Password	*18902*
Calibration Enable	*17901**
Comms Lock	*20904**
Eprom Reset	*19903**

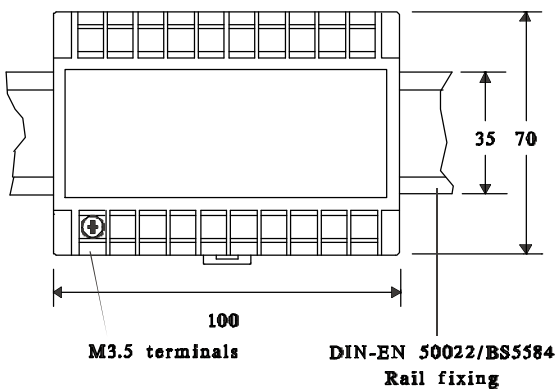
** Note General pass code has to be sent first.*
Examples of typical packets
Reset EEPROM
[01][10][002C][0002][04][469B7E00][B4E5]
General Passcode
[01][10][0042][0002][04][4693AC00][EE23]
Reset Energy
[01][10][0010][0002][04][00000000][F2A3]
Reset Demand
[01][10][0012][0002][04][00000000][737A]
Calibration Passcode
[01][10][0044][0002][04][468BDA00][C86E]
Comms Lock
[01][10][0060][0002][04][46A35000][2CED]
All values are in Hexadecimal.

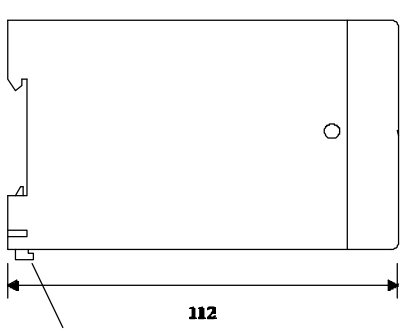
5. INSTALLATION

5.1 Case

The M550 is designed for snap on to Din rail mount 35 x 7.5mm. Complies with DIN-EN 50022

CASE DIMENSIONS





5.2 Auxiliary Supply

The auxiliary supply can be connected in parallel with the measuring input voltage, but this restricts the measuring range of the input voltage to ± 15% of nominal. If the auxiliary is separate the measuring range of the voltage input is 10-120%.

5.3 Protective Fuses

It is good practice for the user to provide fuse protection to all input circuits and the auxiliary supply.

5.4 Current Transformers

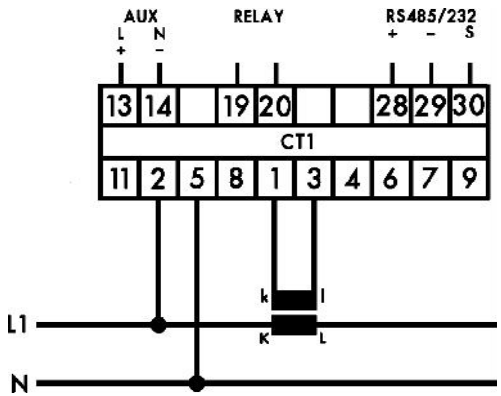
Internally the M550 has current transformers fitted which are either 5 Amp or 1 Amp. The current circuit is designed for connection to the secondary of external current transformers. These transformers should conform to at least Class 1 as per BS7626 (IEC 185) or equivalent. The secondary of these external transformers must have the same nominal current input as that specified on the data label on the side of the M550. e.g. If the M550 has a current ratio specified as 500/5A, then the current transformer could be changed to 800/5A (or any ratio with secondary 5A) and used once the current ratio has been programmed into the M550, (see section 4.2.2.) But if the ratio change was 800/1A the M550 would have to be returned to the factory to have the internal current transformer changed to 1 amp.

Warning. The secondary of a current transformer must never be allowed to be in an open circuit condition when the primary is energized. In the open circuit condition high voltage may be present. Each current transformer secondary should be short-circuited when not connected to the meter.

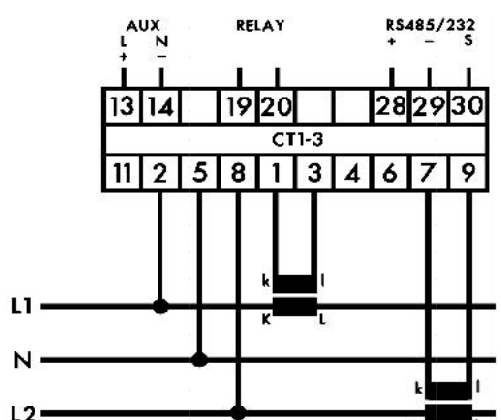
Connection of voltages higher than the rated voltage, that is specified on the M550 data label, is possible using external voltage transformers. These transformers must be at least Class 1 accuracy. The secondary of these transformers must have the same nominal voltage as that specified on the data label on the side of the M550. e.g. If the M550 has a voltage specified as 110 Volts Line to Line, then a Transformer with Ratio of 6600/110 volt can be used, once this ratio has been programmed into the M550 (See section 4.21.) But if the ratio was 6600/400V the unit would have to be returned to the factory or distributor to have internal component changes to cater for the 400 Volt input.

6. CONNECTION DIAGRAMS

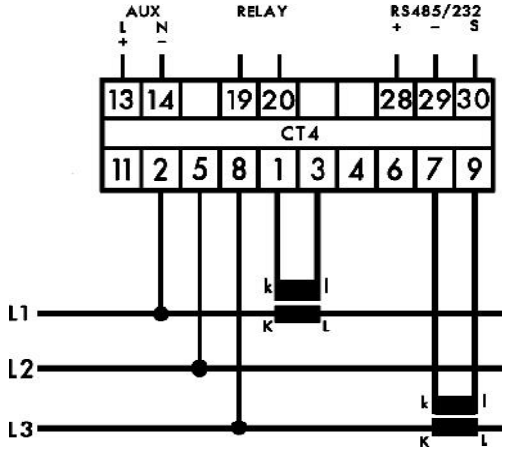
6.1 All connections must be made ensuring, all starts and finishes of current and voltage transformers are connected as shown.



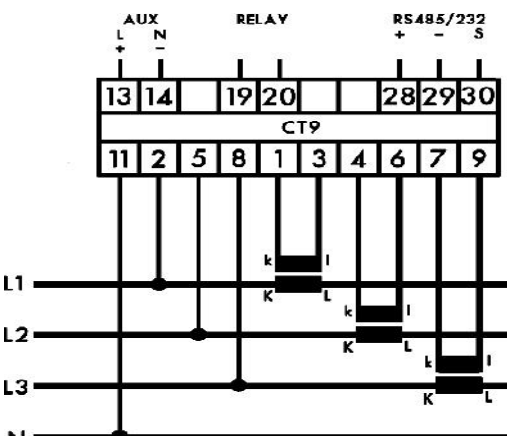
SINGLE PHASE



SINGLE PHASE 3 WIRE



3 PHASE 3 WIRE UNBALANCED LOAD



3 PHASE 4 WIRE UNBALANCED LOAD

7. M550 SPECIFICATIONS

INPUT	
Rated Un	***Direct connected voltages between 57.8 and 600 v. Standard voltages offered :- 63.5/110 V, 69.3 / 120 V, 120 / 208 V, 220/380 V, 230 / 400 V, 240 / 415 V, 277 / 480 V, for 3 ph 4 w 110 V, 120 V, 380 V, 400 V, 415 V, 440V, 480 V, 3 ph 3 w***
Range	***2-120% Un***
Burden	***0.5VA per phase***
Overload	***1.5 x Un continuous 4 x Un for 1 second***
Rated In	***1 or 5 amp***
Range	***0-120%***
Burden	***0.5VA per phase***
Overload	***4 x In continuous 50 x In for 1 second***
Frequency	***50 / 60 Hz nominal range 45/65Hz***

SYSTEMS	***M550-CT1***	***Single phase***
	M550-CT1-3	***Single phase 3 wire***
	M550-CT4	***3 phase 3 wire unbalanced load***
	M550-CT9	***3 phase 4 wire unbalanced load***

ACCURACY	
Specified@	***23 °C 10%-Un 10%-In***
Volt	***Class 0.2% to IEC 688***
Amps	***Class 0.2% to IEC 688***
Frequency	***Class 0.1Hz to IEC 688***
Power Factor	***Class 1.0% to IEC 688***
Active Power	***Class 0.2% to IEC 688***
Reactive Power	***Class 0.2% to IEC 688***
Apparent Power	***Class 0.2% to IEC 688***
Active Energy	***1% of reading IEC 1036***
Reactive Energy	***1% of reading IEC 1036***

AUXILIARY

AC voltage	*115 or 230 volts (±15%)*
DC voltage	*12 / 24 / 48 / 110 / 125 volts*

RELAY OUTPUT : (optional)

Pulsed output	*W.h or VAr.h or VA.h or A.h User progammable import or export*

COMMUNICATION OUTPUT :

Serial communication	*RS485 output Modbus protocol*
Baud Rate	*Programmable 2400,4800,9600 and 19200*
Parity	*Odd, Even or No parity*
Auto Detection	*RS485*

ENVIRONMENTAL

Working Temperature	*0 to +60 deg C*
Storage Temperature	*-30 to +65 deg C*
Temperature Coefficient	*0.01% per deg C*
Relatively Humidity	*0-95% non condensing*
Warm up time	*1 min.*
Shock	*20G in 3 planes*

ENCLOSURE

Fixing	*Snap on to Din rail 35 x 7.5mm complies with DIN-EN 50022*
Mounting	*Any position*
Enclosure Code	*Case IP 50 / terminals IP30 Complies with IEC 529 BS5490 DIN 40050*

APPLIED STANDARDS

General	*IEC 688 BSEN60688, BS4889, IEC 359*
EMC	*Emissions EN61326-1*
	Immunity EN61326-2
Safety	*EN61010-1*

INSULATION

Test Voltage	*4kV RMS 50Hz for 1 min between input, case, auxiliary, RS485*
	3kV RS485 / 1.5kV Relay
Impulse Test	*EMC 5kV transient complying with IEC 801/EN 55020 HF*
Surge withstand	*IEC 801 / EN55020 ANSI C37.90A*
Interference	*EHF 2.5kV 1MHz complying with IEC255-4*
Protection Class II	*Complying with IEC348*

APPROVALS

UL. C-UL, CSA	*Pending*

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